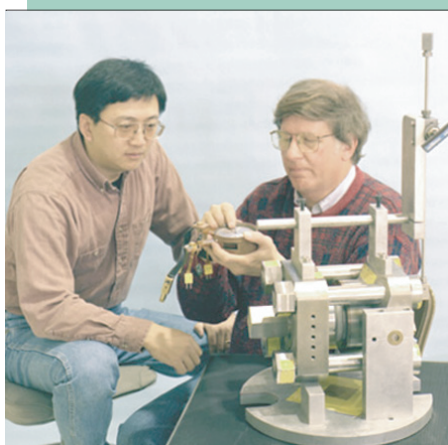


High-Intensity Powder Diffractometer (HIPD)

The High-Intensity Powder Diffractometer (HIPD) is designed to study the atomic structure of materials that are available only in polycrystalline or non-crystalline forms. The beam collimation directs the neutrons into the sample chamber with detectors located at $\pm 153^\circ$, $\pm 90^\circ$, $\pm 40^\circ$, and $\pm 14^\circ$, each covering $\pm 5^\circ$. Over two decades of momentum transfer are available ($0.2\text{--}60\text{ \AA}^{-1}$) to support studies of amorphous solids; magnetic diffraction; small crystalline samples; and samples subjected to extreme environments such as temperature, pressure, or magnetic fields. The exceptionally high data rates of HIPD also make it useful for time-resolved studies. In addition to the standard ancillary equipment (closed-cycle He refrigerator, furnace, texture goniometer), HIPD has a unique high-pressure cell capable of achieving pressures of 10 GPa at ambient temperature with samples up to 100 mm^3 in volume. In addition, this cell can be used simultaneously at high pressures and high temperatures, having achieved 7 GPa at 1600 K.

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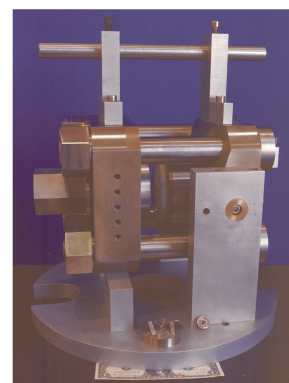
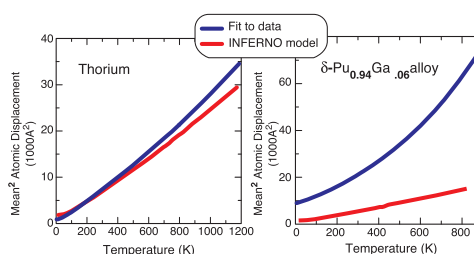


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Instrument scientists Robert Von Dreele and Yusheng Zhao examine the HIPD pressure cell.

Pu Equation-Of-State (EOS) a Key Issue for Primary Certification in the Post-testing Era — LANSCE Provides Unique Data

- Debye-Waller factors guide models used to generate weapons code EOS tables
- INFERNO model has described behavior of many materials over wide range of density and temperature
- Neutron data on Pu-Ga alloy indicate softening at high temperatures not reproduced by INFERNO calculations



Pressure cell

- Tungsten carbide anvil-100 kbar
- Diamond anvil-300 kbar

CIC-1 97-0315

| HIPD Specifications | | | |
|--|---|---|----------------------------|
| Wavelength range | 0.20–10.0 Å | | |
| Beam width | 0.3–1.0 cm, variable | | |
| Beam height | 0.3–5.0 cm, variable | | |
| Q range | 0.2–60 Å ⁻¹ | | |
| d-spacing range (approximate) and resolution | +/- 14° +/- 40° +/- 90° +/- 153° | 2.0–33.6 Å 0.84–13.7 Å 0.40–6.65 Å 0.25–4.75 Å | 3% 1.0% 0.5% 0.3% |
| Moderator | Chilled water at 283 K | | |
| Sample environment | 13–300 K, closed-cycle refrigerator; 10 GPa high-pressure cell; vacuum furnace to 1000 K; texture goniometer | | |
| Sample size | 0.005–4 cm ³ | | |
| Experiment duration | 5 minutes to 1 day, depending on sample size | | |